

Preclass: Figuring Grades

- 1) What grades do **you** consider good? Letter grade(s): _____ Percentages: _____
- 2) Label the following percents as grades, and then multiply by 1.2:

Grade

- a. _____ 90% x 1.2 = _____
- b. _____ 80% x 1.2 = _____
- c. _____ 70% x 1.2 = _____
- d. _____ 60% x 1.2 = _____
- e. _____ 54% x 1.2 = _____

- 3) Your GPA for AP classes is calculated in the same manner as the numbers above. Do you think this matches the letter grade you wrote?

Reading for Thursday:

- **From Chapter 14:**
 - Case studies on p. 344 & 363-4
 - All of Ch 14 Sections 3 & 4 (p. 354-364)

Environmental effects of mineral extraction: MINING

Miller Chapter 14.3
pp. 354 – 360

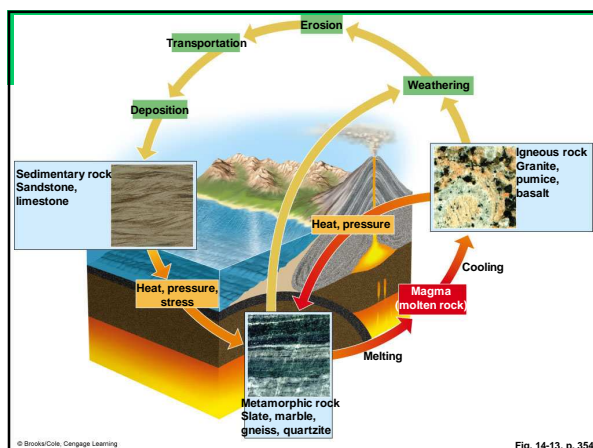
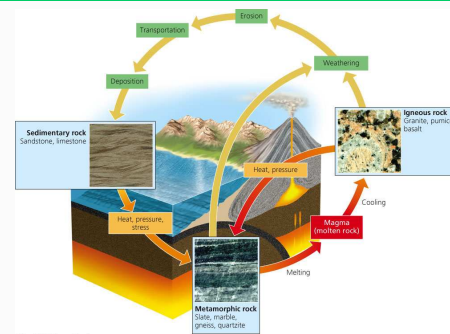
Natural Capital: The Rock Cycle Is the Slowest of the Earth's Cyclic Processes

Fig. 14-13, p. 354

There Are Three Major Types of Rocks (1)

- **Earth's crust**
 - Composed of **minerals** and **rocks**
- **Three broad classes of rocks, based on formation**
 1. **Sedimentary**
 - Sandstone, Shale, Limestone, Bituminous coal
 2. **Igneous**
 - Granite, basalt
 3. **Metamorphic**
 - Anthracite (high-grade coal), Slate, Marble

14-3 What Are Mineral Resources, and what are their Environmental Effects?

- **Concept 14-3A** Some naturally occurring materials in the earth's crust can be extracted and made into useful products in processes that provide economic benefits and jobs.
- **Concept 14-3B** Extracting and using mineral resources can disturb the land, erode soils, produce large amounts of solid waste, and pollute the air, water, and soil.

We Use a Variety of Nonrenewable Mineral Resources

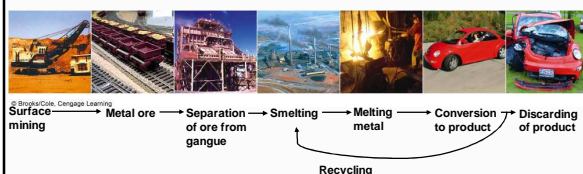
- **Non-renewable mineral resources:**
 1. Fossil fuels
 2. Metallic minerals
 - Aluminum, Gold, Copper, iron, cobalt, manganese, chromium...
 3. Nonmetallic minerals
 - Sand
 - Gravel
 - Limestone
 - Phosphate salt (for inorganic fertilizers)

- **Ore:** a rock that contains a large enough concentration of a particular mineral (often a metal) to make it profitable to mine
- Which do you think is more *economically viable*?
 - High-grade ore
 - Low-grade ore

Converting minerals into useful products Has Advantages & Disadvantages

- **Advantages**
 - Useful products
 - Jobs
 - local, state and federal revenue (\$)
- **Disadvantages**
 - Requires ENERGY
 - Disturbs the local land, water, air, soil...
 - High-grade ores are exploited first
 - Lower-grade ores become profitable but are more difficult to extract
 - → Bigger environmental impact!

The Life Cycle of a Metal Resource



Each step in this process uses large amounts of energy and produces some pollution and waste.

Fig. 14-14, p. 355

NATURAL CAPITAL DEGRADATION

Extracting, Processing, and Using Nonrenewable Mineral and Energy Resources

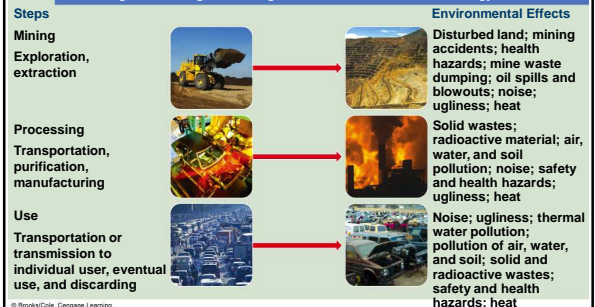


Fig. 14-15, p. 356

There Are Several Ways to Remove Mineral Deposits (1)

1. **Surface mining**
 - Shallow deposits removed
 - 90% of nonfuel mineral & rock resources in USA
 - 60% of coal used in the USA
2. **Subsurface mining**
 - Deep deposits removed

There Are Several Ways to Remove Mineral Deposits

- Type of surface mining used depends on
 - Resource
 - Local topography (land shape)
- Types of surface mining
 - a) Open-pit mining
 - b) Strip mining
 - c) Contour mining
 - d) Mountaintop removal

Open-pit mining

- Machines dig holes and remove ores
- These can be extremely large!
 - You can see a large one near Valley Forge if you fly into Philly from the northwest



Natural Capital Degradation: Open-Pit Mine in Western Australia



Strip mining

- Resources that lie close to the earth's surface in large, horizontal layers ("beds")
- Large machines remove upper layers ("overburden")
- Overburden is dumped into piles

Banks of Waste or Spoils Created by Coal Area Strip Mining in Colorado, U.S.



Contour strip mining

- Used to mine coal on hilly or mountainous areas
- Huge power shovels cut terraces

Natural Capital Degradation: Contour Strip Mining Used in Hilly or Mountainous Region

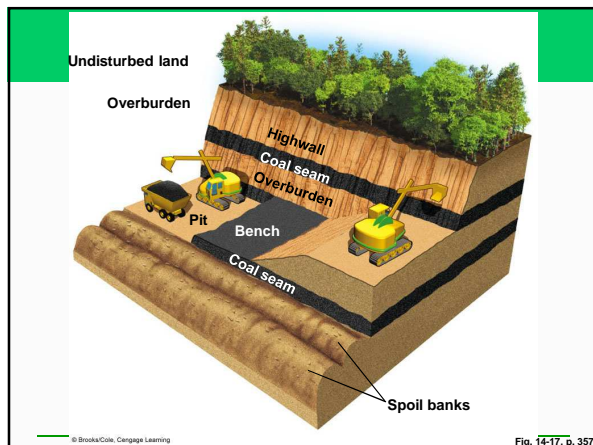
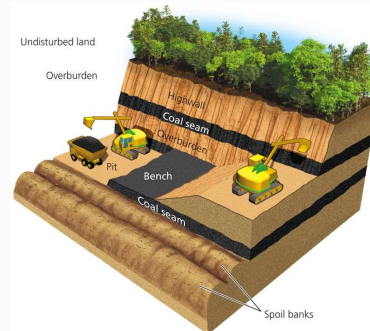


Fig. 14-17, p. 357

Gold Mine with Cyanide Leach Piles and Ponds in South Dakota, U.S.



Core Case Study: Environmental Effects of Gold Mining

- Gold producers
 - South Africa
 - Australia
 - United States
 - Canada
- Cyanide heap leaching
 - Extremely toxic to birds and mammals
 - 2000: Collapse of a dam retaining a cyanide leach pond
 - Impact on organisms and the environment

Mountaintop removal

- Entire mountaintops are removed
- Gangue and overburden fills in the valleys
- Totally changes topography from hilly to flat

Natural Capital Degradation: Mountaintop Coal Mining in West Virginia, U.S.



Subsurface mining

- Resources deeper down are accessed through tunnels and shafts



Mining Has Harmful Environmental Effects (1)

- Scarring and disruption of the land surface
 - E.g., **spoils banks**
- Loss of rivers and streams
 - Especially in mountaintop removal!
- Subsidence - sinking of land

Mining Has Harmful Environmental Effects (2)

- Major pollution of water and air
- Acid mine drainage
 - Effect on aquatic life
- Large amounts of solid waste
 - Chat piles
 - Spoils banks
 - overburden

Removing Metals from Ores Has Harmful Environmental Effects (1)

- Ore extracted by mining
 - Ore mineral
 - Gangue
 - Smelting: heating ores to remove metals from gangue
- Water pollution: **Acid Mine Drainage**
 - Habitable Planet Video #6 at 11:30

Illegal Gold Mine in the Brazilian Amazon



Removing Metals from Ores Has Harmful Environmental Effects (2)

- Liquid and solid hazardous wastes produced
- Use of cyanide salt to extract gold from its ore
 - Summitville gold mine: Colorado, U.S.
 - Case study p. 363

Ecological Restoration (Remediation) of a Mining Site in New Jersey, U.S.



Natural Capital Degradation: Summitville Gold Mining Site in Colorado, U.S.

